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Southwest Division
Naval Facilities Engineering Command
San Diego, California**

**LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

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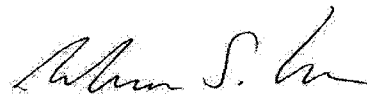
July 2, 2002

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Enclosure (1) is provided for your review. This Technical Memorandum is provided as an information resource to be used in determining future actions at Site 01/21. As such, your comments are welcomed but not required on this document. Future updates will be provided as more data is gathered and validated.

Should you have any concerns with this matter, please contact Mr. Charles "Maz" Mazowiecki, Project Manager, at (619) 532-0902, or me at (619) 532-0913.

Sincerely,

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By direction of the Commander

Encl: (1) Landfill Gas Technical Memorandum, Parcel E, Industrial Landfill Hunters Point Shipyard, San Francisco, California, June 28, 2002

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Everyone:

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A revised signature page is also attached for your reference.

Sorry for the confusion.

Mike Wanta
Tetra Tech EM Inc.
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Figure 4_final.pdf Final_signature.pdf

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ACRONYMS AND ABBREVIATIONS

27 CCR	Title 27 of the California Code of Regulations
BAAQMD	Bay Area Air Quality Management District
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
FSP/QAPP	Field sampling plan and quality assurance project plan
HPS	Hunters Point Shipyard
GMP	Gas monitoring probe
IR	Installation Restoration
LEL	Lower explosive limit
Navy	U.S. Department of the Navy
ppbv	Parts per billion by volume
PRG	Preliminary remediation goal
RI	Remedial investigation
Tetra Tech	Tetra Tech EM Inc.
TO	Toxic Organics
TVOC	Total concentrations of detected nonmethane VOCs
UCSF	University of California, San Francisco
VOC	Volatile organic compound

EXECUTIVE SUMMARY

This technical memorandum summarizes the results of the landfill gas investigation at the Industrial Landfill, which is part of Installation Restoration Site 01/21, in Parcel E of Hunters Point Shipyard. The purpose of the landfill gas investigation was to characterize gases originating from the landfill and to delineate the lateral extent of gas migration. The investigation was performed in three parts as discussed below.

Part One, Ambient Air Surveys. These surveys consisted of checking both on-site and off-site locations for the presence of landfill gases. The results of the on-site survey indicated the following:

- Landfill gas was not detected in the breathing zone at any on- or off-site locations
- Landfill gas was detected within wells and vaults located on or close to the landfill
- Landfill gas was detected only at trace concentrations in the crawlspace of Building 830
- Landfill gas was detected at the ground surface at four outdoor locations

Follow-up monitoring will be continued within the crawlspace of Building 830 and at the four outdoor locations where landfill gas was detected during the off-site ambient air surveys.

Part Two, Soil-Gas Survey. This survey was conducted around the perimeter of the landfill. The U.S. Department of the Navy (Navy) delineated the lateral extent of methane in the subsurface near the landfill based on the field screening results, which correspond closely with the laboratory analytical results. The results of the soil-gas survey within the subsurface indicated the following:

- Methane and trace amounts of other landfill gases were detected near the Parcel E industrial landfill
- Methane was detected at higher concentrations along the northern side of the landfill, where the adjacent area is paved
- No methane was detected north of Crisp Avenue
- Methane concentrations dissipated quickly with distance from the landfill along the eastern, southern, and western sides of the landfill

Part Three, Installation of 21 Permanent Gas Monitoring Probes (GMP). The GMP installation was based on the results of the soil-gas survey; GMPs were installed west and north of the landfill, and along

Crisp Avenue. The Navy then conducted two GMP quarterly monitoring events. Field results indicated that methane was not detected in any of the GMPs located along Crisp Avenue.

The Navy currently proposes installing additional GMPs, as part of an emergency removal action, on the property north of the landfill once access is obtained from the property owner, the University of California, San Francisco. Ongoing monitoring activities will establish temporal trends in the monitoring data.

1.0 INTRODUCTION

This technical memorandum summarizes the results of the landfill gas investigation at the Industrial Landfill, which is part of Installation Restoration (IR) Site 01/21 in Parcel E of Hunters Point Shipyard (HPS) in San Francisco, California. Figure 1 shows the relative location of the Parcel E industrial landfill at HPS. The landfill gas investigation was conducted as part of the overall Parcel E nonstandard data gaps investigation in accordance with the approved field sampling plan and quality assurance project plan (FSP/QAPP) (Tetra Tech EM Inc. [Tetra Tech] 2002).

During preparation of the original Parcel E remedial investigation (RI) (Tetra Tech 1997) and feasibility study (FS) (Tetra Tech 1998a) reports, the U.S. Department of Navy (Navy), the regulatory agencies, and the project team identified additional tasks required to fill data gaps and to support the remedial design for the Parcel E Industrial Landfill. Based on regulatory agency input, community input, and scheduling issues, the Parcel E data gaps investigation was planned and implemented in two parts: the standard data gaps investigation and the nonstandard data gaps investigation. One of the primary reasons the nonstandard data gaps investigation was planned and implemented separately was to allow accelerated implementation of the landfill gas investigation, which is a regulatory agency and community concern.

As part of the nonstandard data gaps investigation, the lateral extent of waste was delineated along the northern and western perimeters of the landfill with test pits and borings. The extent of waste as determined during the lateral extent of waste fill investigation is shown on Figure 2. The delineation of the extent of waste was performed before the landfill gas investigation because an accurate waste fill footprint was critical to those portions of the landfill that would be investigated around the perimeter of the landfill.

The purpose of the landfill gas investigation was to characterize gases originating from the landfill and to delineate the lateral extent of gas migration. The Navy will incorporate the results of this landfill gas investigation into the revised Parcel E RI/FS report.

The scope of the landfill gas investigation consisted of three parts:

1. Ambient air monitoring conducted along the perimeter and surface of the landfill cap area and in the vicinity and inside buildings and subterranean structures
2. A soil-gas survey conducted around the perimeter of the landfill
3. Installation of permanent gas monitoring probes (GMP) and ongoing monitoring activities

The purpose of this technical memorandum is to present the field and laboratory data collected during the landfill gas investigation to date. Section 2.0 describes the general methodology used during the investigation. Section 3.0 describes the ambient air monitoring surveys. Section 4.0 summarizes the soil-gas survey. Section 5.0 describes the long-term monitoring conducted to date. References used throughout this memorandum are listed in Section 6.0.

2.0 GENERAL METHODOLOGY

The initial field effort for the landfill gas investigation was conducted from February through April 2002. Table 1 summarizes the field and analytical methods used. The investigation was conducted in general accordance with the FSP/QAPP and Tetra Tech standard operating procedures. Photographs taken during the Parcel E landfill gas field investigation are included as Appendix A. A more detailed description of the methodology is available in the approved FSP/QAPP (Tetra Tech 2002).

Field methods included the use of real time instruments to measure concentrations of methane, combustible gases, or other volatile organic compounds (VOC) in ambient air or in soil-gas. Gaseous samples collected in Summa® canisters were analyzed using U.S. Environmental Protection Agency (EPA) Method Toxic Organics (TO)-14a, EPA Method 25C, and EPA Method 3C.

3.0 AMBIENT AIR MONITORING

Ambient air monitoring consisted of surveying on- and off-site locations for the presence of combustible gases. For this investigation, "on-site" refers to the fenced-in area around the footprint of the landfill, as shown on Figure 2. A portion of the landfill footprint extends north, past the Parcel E boundary, onto property owned by the University of California, San Francisco (UCSF). The UCSF property is shown in pink on Figure 2.

3.1 MONITORING LOCATIONS AND METHODS

Ambient air surveys were conducted in accordance with the FSP/QAPP (Tetra Tech 2002). For this investigation, measurements taken between 0 and 6 inches above ground surface are considered to be at "ground surface," and measurements taken between 3 and 5 feet above ground surface are considered to be within the "breathing zone."

On- and off-site ambient air surveys were conducted in four major areas on and around the industrial waste landfill, as follows:

- Along the perimeter and on the surface of the landfill cap
- Inside and outside each monitoring well within the entire extent of the landfill
- Inside and outside accessible buildings and subterranean structures
- On the landfill surface in the area immediately west of the landfill cap

The on-site ambient air surveys were designed to determine whether methane or other combustible gases could be detected at any surface locations. The joints between the landfill cap and wells, vents, and other structures were monitored. The specific locations surveyed during the on-site ambient air surveys are shown in dark blue on Figure 3.

Off-site monitoring of ambient air focused on typical areas of concern for build-up of potentially explosive concentrations of methane (such as cracks along floors, edges of foundations, and the ground surface) and the breathing zone within buildings for methane and VOCs. The locations surveyed during the off-site ambient air surveys are shown in dark blue on Figure 4. In accordance with the FSP/QAPP, the Navy conducted an ambient air survey in and around the accessible buildings and subterranean structures within 300 feet of the perimeter of the landfill (shown in light blue on Figure 4). Abandoned kennels and storage trailers located north of the landfill were also surveyed and are shown as the unlabeled structures west of Building 830 on Figure 4. In addition, the ambient air survey was extended to Buildings 808, 809, 810, and 815, which are outside the 300-foot perimeter planned in the FSP/QAPP. Follow-up surveys were conducted at off-site locations where methane was detected.

3.2 RESULTS

This section briefly summarizes the results of the on-site, off-site, and follow-up ambient air surveys. Appendix B includes the field reports from the individual surveys. Table 2 summarizes the results of the on-site ambient air survey. Table 3 summarizes the results of field measurements for off-site ambient air survey. Table 4 summarizes the laboratory analytical results for samples collected during the ambient air surveys.

3.2.1 On-Site Ambient Air Survey

During the on-site ambient air survey, field personnel monitored 19 groundwater monitoring wells, one vault, one electrical substation, and the surface and perimeter of the landfill cap for the presence of combustible gases. The results of this survey indicated that combustible gases were not present in ambient air at any of the surface locations in detectable concentrations (Table 2).

As expected, combustible gases were detected at substantial levels within and around most of the monitoring wells and within some of the subsurface enclosures (Table 2). Specifically, combustible gases were detected near vault A and wells IR01MW18A and IR01MW38A. It should be recognized, however, that these locations are not truly "ambient" air but represent the types of locations where combustible gases typically accumulate at landfills.

No samples were collected for laboratory analysis during the on-site ambient air survey.

3.2.2 Off-Site Ambient Air Survey

During the off-site ambient air survey, field personnel monitored buildings, subterranean structures, and several outdoor locations for the presence of combustible gases and VOCs. Figure 4 shows the off-site locations surveyed during the investigation. Field measurements were collected in and around the following buildings: 808, 809, 810, 815, and 830 (Figure 4). Building 820 was not surveyed because it is located on private property, and the property owner denied access to the interior and outside perimeter of the building. Because Buildings 816 and 817A are sealed, access was impossible, and the building interiors were not surveyed. The immediate areas surrounding Buildings 816 and 817A, including the building-to-ground interface, holes in the walls, and nearby vaults, were also surveyed. Field personnel identified the following subterranean structures within the study area: 19 storm drains, utility manholes, trench boxes, and vaults.

Field measurements indicated that combustible gases were not detected within the breathing zone at any surveyed location (Table 3). Combustible gases in ambient air at ground surface were below detectable concentrations in all surveyed areas except four outdoor locations, as described below.

Concentrations of combustible gases were detected at or exceeding concentrations of 100 percent of the lower explosive limit (LEL) at one location, the light pole located on UCSF property, shown as location F on Figure 4. Concentrations of combustible gases were detected at less than 100 percent of the LEL (5 to 37 percent of the LEL) in two locations along the fence between the landfill and UCSF compound and at location B (Figure 4). All four of these locations are adjacent to the utility trench that runs along the fenceline to the light pole (location F) in the western corner of the UCSF property (Figure 4).

To confirm the field survey results, field personnel collected an ambient air sample at the ground-to-light pole interface in a Summa® canister, and submitted the sample to the laboratory for analysis on April 5, 2002. The analytical results indicated that methane was not detected by EPA Methods 3C and 25C (Table 4). Results for other VOCs were compared with EPA Region 9 preliminary remediation goals

(PRG) for ambient air (EPA 2000) (Table 4). Three VOCs were detected below the reporting limit of the method, but were estimated to be at concentrations above ambient air PRGs: 1,1,2,2-tetrachloroethane (1.18 parts per billion by volume [ppbv]); 1,3,5-trimethylbenzene (1.31 ppbv); and benzene (1.01 ppbv).

No landfill gases were detected in the crawlspace of Building 830 during the field survey (Table 3). To confirm the field survey results, field personnel collected a sample of ambient air in the crawlspace below Building 830 in a Summa® canister, and submitted the sample to the laboratory for analysis on April 5, 2002 (Table 4). The analytical results indicated that methane was detected at trace concentrations of 1.16 to 2.0 percent of the LEL. Two specific VOCs were detected below the reporting limit but were estimated to be at concentrations above ambient air PRGs: tetrachloroethene (1.73 ppbv) and chloromethane (1.43 ppbv).

In accordance with Section 20919.5 of Title 27 of the *California Code of Regulations* (27 CCR), the concentration of methane gas may not exceed 25 percent of the LEL in ambient air within on-site structures. However, 27 CCR does not set regulatory limits for off-site structures such as Building 830.

3.2.3 Follow-up Ambient Air Surveys

Because combustible gas was detected during the initial survey at the light pole located in the western corner of the UCSF property and at location B, near a shed on UCSF property, these areas were monitored during follow-up ambient air surveys (Appendix B). These subsequent field measurements of ambient air indicated that combustible gas concentrations remained below 25 percent of the LEL.

Because of the methane detections in soil-gas near Building 830, field personnel also monitored ambient air within the crawlspace of Building 830 during follow-up surveys (Appendix B). Landfill gases were not detected in the ambient air of the crawlspace during any of the follow-up field surveys (Table 3).

3.3 PLANNED FUTURE MONITORING

Ongoing ambient air monitoring activities include weekly field measurements of combustible gases and total VOCs in ambient air. Locations that are monitored include the light pole in the western corner of the UCSF property, location B (near a shed on the UCSF property), areas along the fenceline between the landfill and the UCSF property, and the crawlspace of Building 830 (Figure 4). Two additional gas samples will be collected in Summa® canisters from the crawlspace of Building 830 to confirm previous laboratory results. Follow-up ambient air surveys will be conducted in accordance with the methodology outlined in the FSP/QAPP (Tetra Tech 2002).

4.0 SOIL-GAS SURVEY

The soil-gas survey was conducted around the perimeter of the landfill and in step-out locations to characterize the nature and horizontal extent of landfill gas at the Parcel E Industrial Landfill. Figure 5 shows the soil-gas survey locations.

4.1 MONITORING LOCATIONS AND METHODS

Field personnel installed temporary probes to monitor soil-gas concentrations around the landfill's western, northern, and eastern perimeters using direct-push drilling methods. An initial boring was advanced at each location to select the depths for soil-gas sampling. Depths for soil-gas samples were selected in accordance with the FSP/QAPP (Tetra Tech 2002). Concentrations of methane and total nonmethane VOCs in soil-gas were measured by advancing a new boring immediately adjacent to (about 1 foot away from) the initial boring to the desired depth and by taking direct measurements with the field meters.

Step-out borings were advanced to delineate the lateral extent of subterranean methane until combustible gases were not detected above the lower quantitation limit of the instrument (0.5 percent of the LEL). Step-out borings were located about 20 to 50 feet out (away from the landfill) from the initial locations (Figure 5). Field personnel selected the final step-out locations based on the presence of existing structures and other site obstacles (Table 5).

Field personnel also collected soil-gas samples in Summa® canisters for laboratory analysis in accordance with the FSP/QAPP (Tetra Tech 2002). Additional soil-gas samples were collected to confirm field measurements. Table 5 presents the rationale for step-out sample collection.

4.2 RESULTS

Table 5 and Figure 5 present the results of field measurements. Table 6 summarizes the laboratory analytical results. Appendix C includes the boring logs for boreholes advanced during the soil-gas survey.

4.2.1 Field Screening Results

From March 25 through April 5, 2002, field personnel collected 92 field screening samples by advancing temporary soil-gas borings at 22 locations around the perimeter of the site, and at 34 stepped-out locations (Figure 5). The table below summarizes the field methane results.

Concentration of Methane	Number of Samples	Action Taken
Greater than 100 percent of the lower explosive limit (LEL) (the regulatory limit for soil-gas at the property boundary)	40	A sample was collected for laboratory analysis at each location, and a step-out boring was advanced if possible
Between 25 and 100 percent of the LEL	3	A sample was collected for laboratory analysis at each location, and a step-out boring was advanced if possible
Less than 25 percent of the LEL	17	Collection of samples for laboratory analysis was not required at these locations; however, a step-out boring was advanced if possible
Not detected (less than 0.5 percent of the LEL)	32	Neither samples for laboratory analysis nor step-out borings were required

The data indicated that methane dissipates quickly along the eastern, southern, and western sides of the landfill, where no continuous confining layers were observed at the surface or in the subsurface. Along the northern side of the landfill, however, methane was detected where waste fill extends up to the northern fenceline (Figure 5). Immediately north of the fenceline, the area is paved, providing a confining layer through which landfill gases cannot dissipate. Methane gas concentrations drop below detectable levels along the northern edge of the asphalt pavement. Based on these results, Figure 5 shows the lateral extent of methane detected near the landfill.

The table below summarizes the results of field screening for total nonmethane VOCs during the soil-gas survey and the subsequent action taken regarding collection of Summa® canister samples for laboratory analysis.

Concentration of Nonmethane Volatile Organic Compounds	Number of Samples	Action Taken
Greater than 5 parts per million above background	11	A sample was collected for laboratory analysis at each location
Less than 5 parts per million above background	56	Samples for laboratory analysis were not required
Not detected (less than 0.1 part per million)	25	Samples for laboratory analysis were not required

4.2.2 Laboratory Analytical Results

Field personnel collected 61 soil-gas samples in Summa® canisters from 39 temporary soil-gas locations and submitted the samples to the laboratory for analysis by EPA Methods TO-14A, 25C, and 3C. One sample, collected from location SG02, was damaged during shipping and was rejected for analysis by the laboratory. Table 6 presents the laboratory analytical results. Figure 6 shows the sampling locations and

summarizes the methane analytical results, and Figure 7 shows the sampling locations and summarizes the total nonmethane VOC analytical results.

The table below summarizes the laboratory results for methane.

Concentration of Methane (EPA Method 3C)	Number of Laboratory Samples
Greater than 100 percent of the LEL (the regulatory limit for soil-gas at the property boundary)	38
Between 25 and 100 percent of the LEL	3
Less than 25 percent of the LEL	4
Not detected	15
Total Samples:	60

In general, laboratory analytical results for methane correspond with the field screening results, confirming the lateral extent of methane detected near the landfill. The lateral extent of methane based on the laboratory analytical results is shown on Figure 6.

Since the Bay Area Air Quality Management District (BAAQMD) regulates emissions of total VOCs at 10 pounds per day, this technical memorandum presents the results in total concentrations of detected nonmethane VOCs (TVOC). Although these concentrations cannot be directly compared with BAAQMD regulations, they provide a comparison with potential emissions from the gas extraction system that is being installed at the site as an emergency removal action. TVOC results for the soil-gas using EPA Method 14a actually represent a conservative basis for comparison to a potential emission standard. The table below and Figure 7 summarize the TVOC results.

Total Concentration of Detected Nonmethane Volatile Organic Compounds	Number of Samples	Comments
Greater than 10,000 ppbv	2	Locations SG01D and SG12
Between 1,000 and 10,000 ppbv	29	Generally located near the landfill
Between 100 and 1,000 ppbv	17	Generally located in step-out locations
Between 10 and 100 ppbv	9	Generally located in step-out locations
Less than 10 ppbv	3	Located in step-out locations

Nonmethane VOC analytical results were not found to correspond with recorded field screening measurements. Many field screening measurements were taken just above groundwater or where groundwater was present at shallow depths. In general, higher total nonmethane VOC results did correlate with higher methane results. Both types of landfill gases were present at higher concentrations

along the northern side of the landfill, where the area adjacent to the landfill is paved, and gases cannot dissipate. Table 6 presents the analytical results for individual compounds.

5.0 LONG-TERM SOIL-GAS MONITORING

After the initial soil-gas survey was completed, field personnel installed 12 GMPs along the site perimeter, inside the fenceline, and along the landfill's northern perimeter. Figure 8 shows the GMP locations. Field personnel then initiated long-term monitoring of the GMPs and four on-site groundwater monitoring wells for landfill gas. The Navy will submit the laboratory results of each of the landfill gas monitoring events separately. Nine additional GMPs were installed along Crisp Avenue and along the western perimeter of the landfill, and five additional GMPs are currently proposed for installation in the area between the landfill and Crisp Avenue in June 2002 (Figure 8).

5.1 MONITORING LOCATIONS AND METHODS

Field personnel installed GMPs in accordance with the FSP/QAPP (Tetra Tech 2002). As a result of the shallow depth to groundwater in all areas at the site, sufficient space was unavailable for multi-depth completions; therefore, a single screened section was installed at each GMP (Table 7). Appendix C includes the boring logs that detail the lithology and construction of each GMP. Appendix A contains photographs taken during the installation of the GMPs. The rationale for selection of GMP locations is included in the "Work Plan and Location Rationale for GMP Installation," included as Appendix D.

5.2 CURRENTLY AVAILABLE RESULTS

This section presents the results currently available from the installation and monitoring of the 21 GMPs installed near the Parcel E industrial landfill. Geologic information gathered during GMP installation is included in Figures 9 through 12. Field data collected during the first two monitoring events are summarized in Table 8. Laboratory results of gaseous samples collected during the GMP monitoring events will be provided separately once they become available.

5.2.1 Geologic Data

The geology is based on field observations conducted during the installation of the GMPs and field confirmations of the geology presented in the "Basewide Environmental Baseline Survey" (Tetra Tech 1998b) during the GMP installation. Figure 9 shows the geology in the area of the Parcel E industrial landfill and cross-section locations. Individual cross-sections are provided as Figures 10 through 13. Figure 14 shows the historical shorelines at HPS.

Previously mapped geologic units in the Parcel E industrial landfill area include the Jurassic-Cretaceous age, Franciscan Assemblage, and Quaternary-age unconsolidated deposits, which are predominantly artificial fill (Figure 9). The Franciscan Assemblage is bedrock and forms most of what was the original peninsula at HPS (Figure 14). It underlies the basin sediments and consists of sandstone, shale, chert, greenstone, and serpentinite. The serpentinite, which forms the major portions of the hills at HPS, has been described as ranging from very hard rock to medium-soft material. In the vicinity of Crisp Avenue, bedrock consists primarily of serpentinite and greenstone with some chert and is encountered at depths of 4 to 16 feet below ground surface (Figures 10 through 12). This description is consistent with the occurrence of bedrock outcrops north of Crisp Avenue. Fractures are typically present throughout the Franciscan Assemblage and may act as conduits for groundwater or soil-gas flow. Minor fracturing is observed in the bedrock outcrop north of Crisp Avenue. No major fractures, faults, or joint sets are noted along this outcrop.

As observed during GMP installation activities, the area north of the landfill, in the vicinity of the UCSF property and along Crisp Avenue, appears to consist primarily of heterogeneous fill (Figure 9). Based on borings completed in the area to date, the fill consists of clays, sandy clays, and clayey sands (Figures 10 through 13). The GMP borings completed within the utility trenches along Crisp Avenue indicate that backfill material within the utility trenches consists of similar fill material to that observed throughout the area. No imported-type pea gravel or fill sands were observed in the utility trench borings. Two small gravel lenses were noted in the logs from GMP15 and GMP18. Both of these occurrences were located immediately above bedrock and likely represent the surface of the weathered bedrock. Copies of these boring logs are included in Appendix C.

The GMP borings completed along the western perimeter of the landfill indicate that similar fill materials (clays, sandy clays, and clayey sands) exist west of the landfill. Groundwater is encountered at very shallow depths (less than 5 feet) west of the landfill, and is almost present at ground surface along the drainage ditch west of the landfill (Figure 13).

5.2.2 Field Soil-Gas Data

The Navy conducted the first two GMP monitoring events on April 22 and June 5, 2002. Field data collected at these events are presented in Table 8. Field measurement results generally correspond with the laboratory results of the temporary soil-gas survey (Tables 6 and 8). Field results indicated that methane was not detected in any of the GMPs located along Crisp Avenue.

5.3

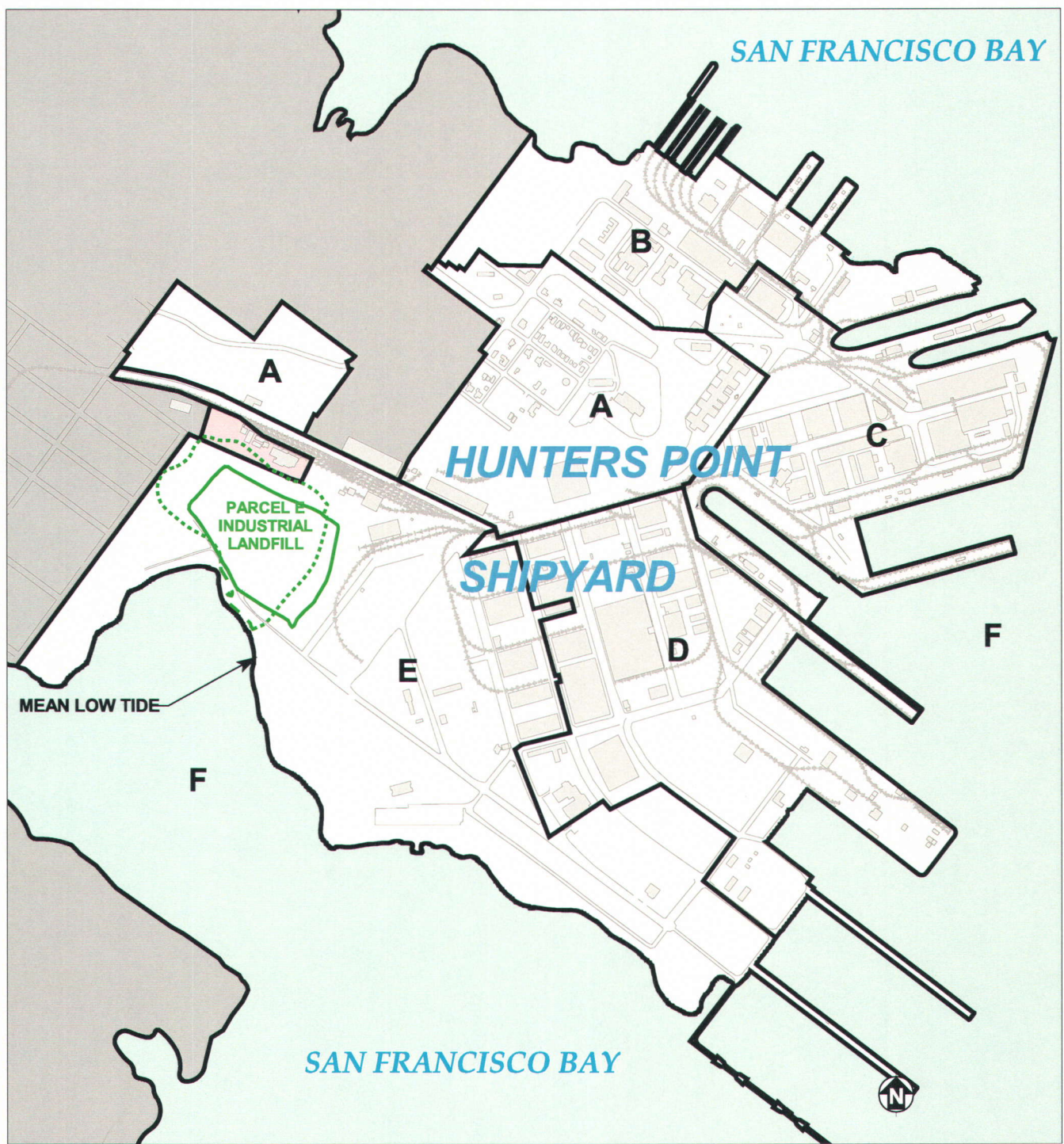
PLANNED FUTURE MONITORING

Ongoing landfill gas monitoring activities include weekly field measurements at GMPs to establish temporal trends in the monitoring data. The Navy is conducting quarterly monitoring of the GMPs and selected groundwater monitoring wells in accordance with the approved FSP/QAPP (Tetra Tech 2002).

Weekly monitoring consists of field measurements of methane, VOCs, barometric pressure, probe pressure, probe temperature, ambient temperature, and depth to water at each GMP. Each quarterly monitoring event includes collection of (1) field measurements at each of the GMPs, (2) soil-gas samples for laboratory analysis at each GMP with concentrations of methane exceeding 25 percent of the LEL, and (3) a soil-gas sample from groundwater monitoring well IR01MW16A. Samples collected for laboratory analysis will be analyzed by EPA Method TO-14a, EPA Method 25C, and EPA Method 3C.

6.0 REFERENCES

- Tetra Tech EM Inc. (Tetra Tech). 1997. "Draft Final Parcel E Remedial Investigation Report, Hunters Point Shipyard [HPS], San Francisco, California." October 27.
- Tetra Tech. 1998a. "Draft Parcel E Feasibility Study, HPS, San Francisco, California." January 15.
- Tetra Tech. 1998b. "Draft Basewide Environmental Baseline Survey, Revision 01, HPS, San Francisco, California." May 1.
- Tetra Tech. 2002. "Draft Final Field Sampling Plan and Quality Assurance Project Plan (FSP/QAPP), for Parcel E Nonstandard Data Gaps Investigation (Industrial Landfill and Wetlands Delineation), HPS, San Francisco, California." January 8.
- U.S. Environmental Protection Agency (EPA). 2000. "EPA Region 9 Ambient Air Preliminary Remediation Goals (PRG)." Updated November 22. Online Address accessed on May 15, 2002: http://www.epa.gov/Region9/waste/sfund/prg/s1_01.htm



Location Map

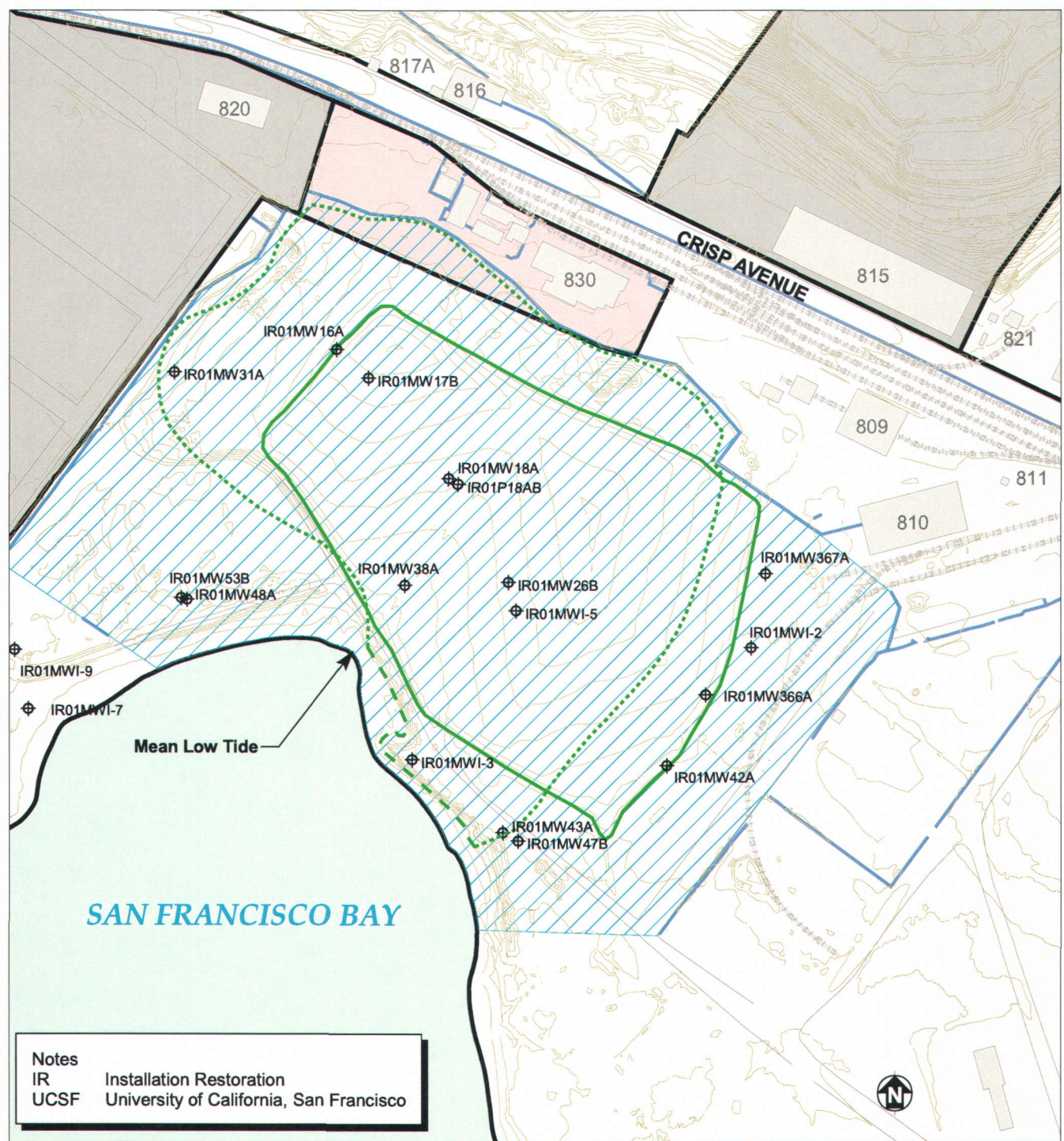


- Approximate Extent of Landfill
- Extent of Landfill
- Parcel Boundary
- Buildings
- Rail Lines
- Roads
- University of California, San Francisco Property
- Non-Navy Property

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

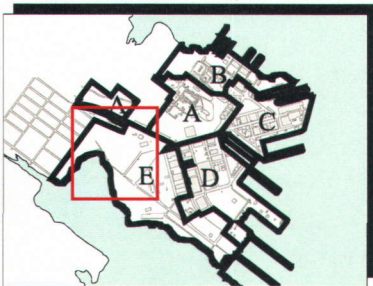
FIGURE 1

SITE LOCATION MAP
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL



Notes
 IR Installation Restoration
 UCSF University of California, San Francisco

Location Map



- Approximate Extent of Landfill
- Extent of Landfill
- + IR-01/21 Monitoring Wells/Piezometers
- Limit of Landfill Cap
- Ground Surface Elevation (2-Foot Contours)
- On-Site Investigation Area
- Buildings
- Rail Lines
- Parcel Boundary
- Roads
- Non-Navy Property
- Fences
- UCSF Property

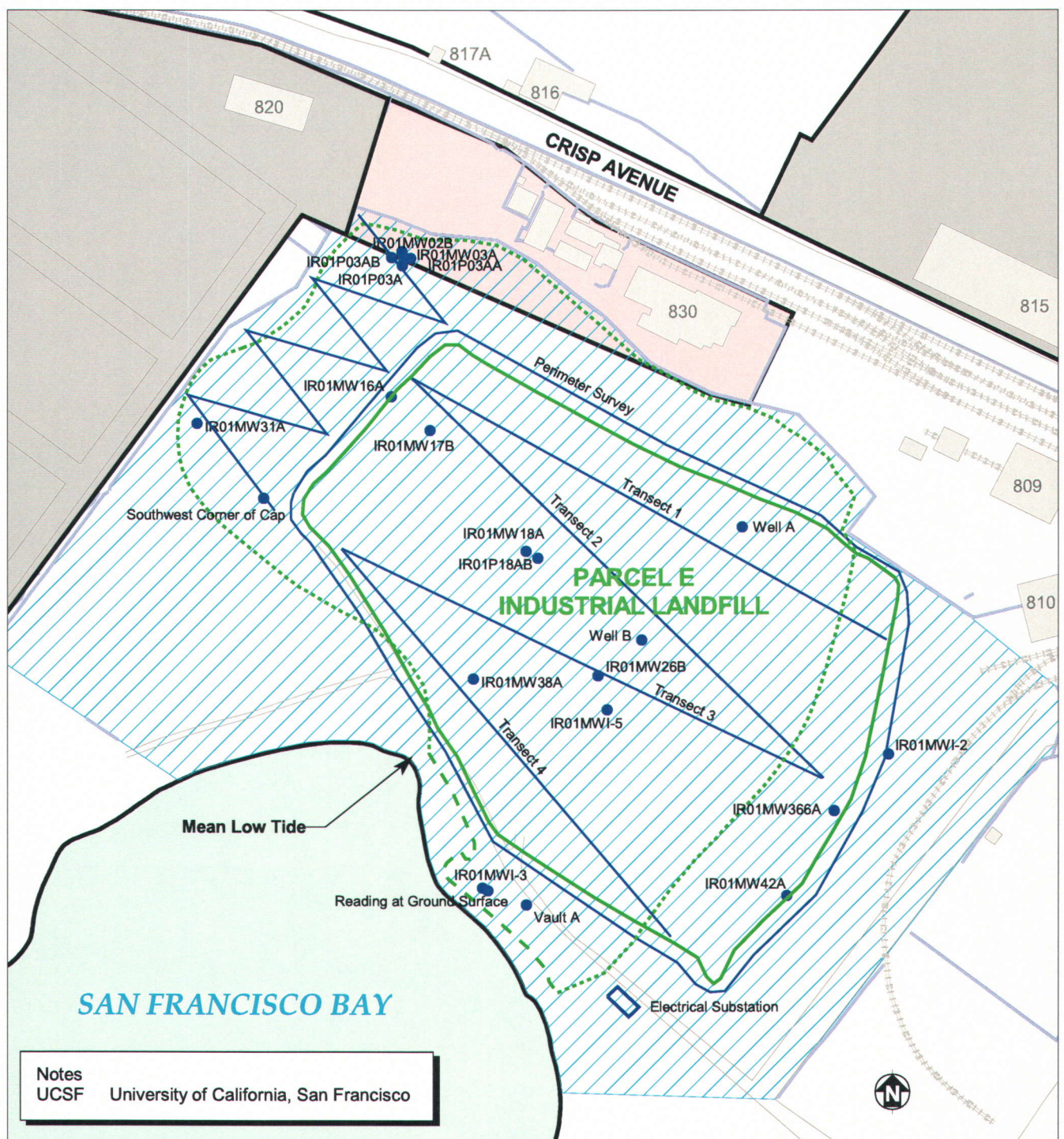
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 Scale in Feet

**HUNTERS POINT SHIPYARD
 SAN FRANCISCO, CALIFORNIA**
 U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

FIGURE 2

PARCEL E INDUSTRIAL LANDFILL
 LANDFILL GAS TECHNICAL MEMORANDUM
 PARCEL E INDUSTRIAL LANDFILL

Tetra Tech EM Inc.

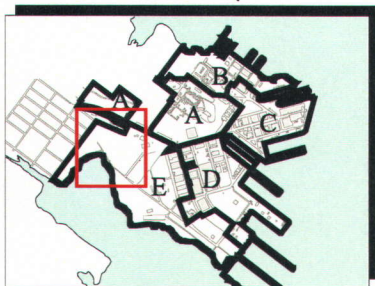


Notes
UCSF University of California, San Francisco



100 0 100 200
Scale in Feet

Location Map



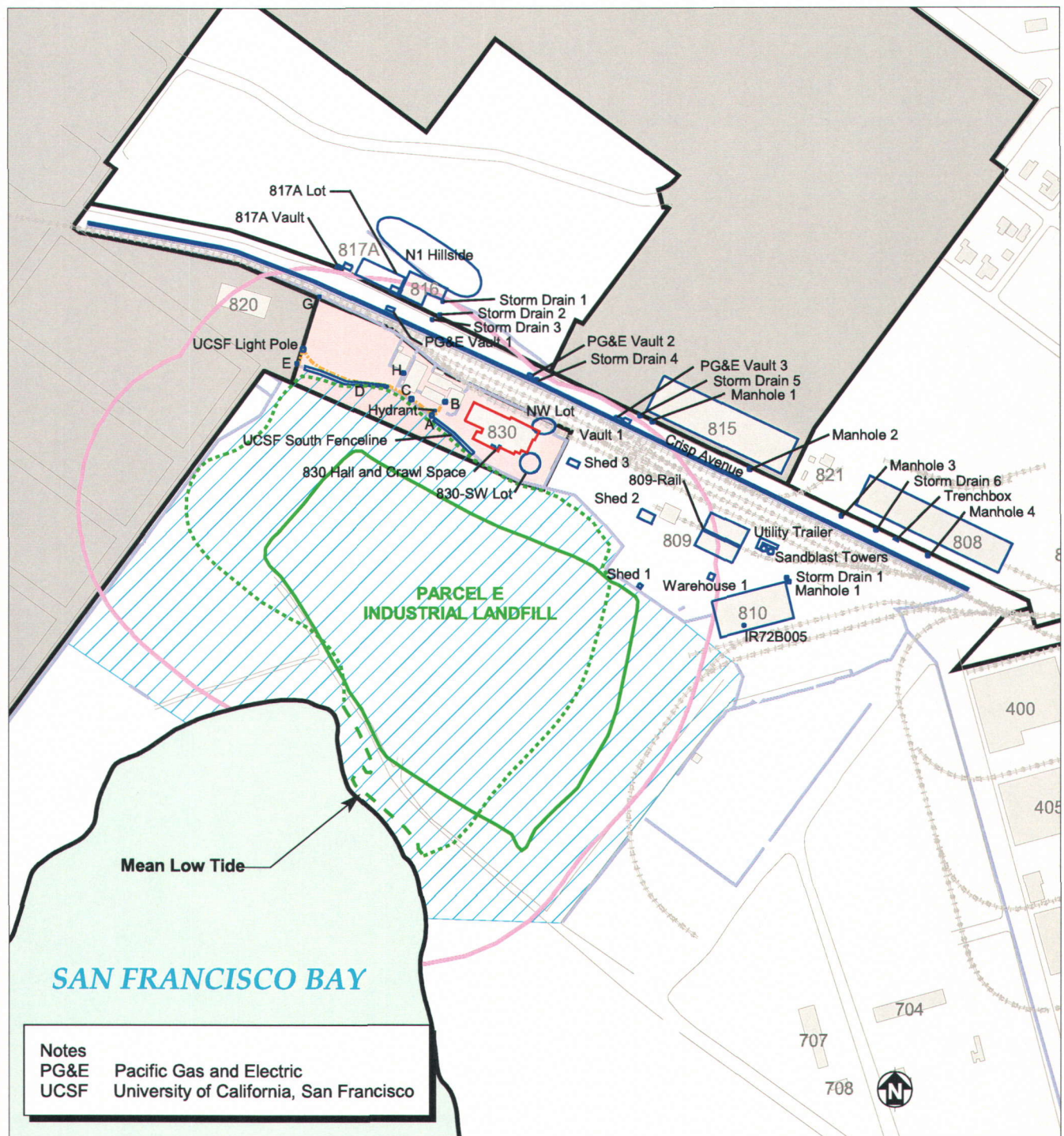
- Approximate Extent of Landfill
- Extent of Landfill
- Limit of Landfill Cap
- Ambient Air Survey Locations
- Ambient Air Survey Locations
- Buildings
- Rail Lines
- Roads
- Non-Navy Property
- Fences
- On-Site Investigation Area
- UCSF Property
- Parcel Boundary

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

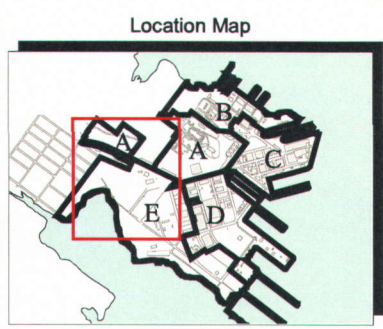
FIGURE 3

ON-SITE AMBIENT AIR SURVEY
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL

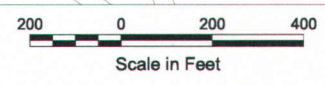
Tetra Tech EM Inc.



Notes
 PG&E Pacific Gas and Electric
 UCSF University of California, San Francisco



- Approximate Extent of Landfill
- Extent of Landfill
- Limit of Landfill Cap
- Ambient Air Survey Locations
- Subsurface Utility In UCSF Property
- 300-Foot Perimeter
- Buildings
- Rail Lines
- Roads
- Non-Navy Property
- Fences
- On-Site Investigation Area
- UCSF Property
- Parcel Boundary

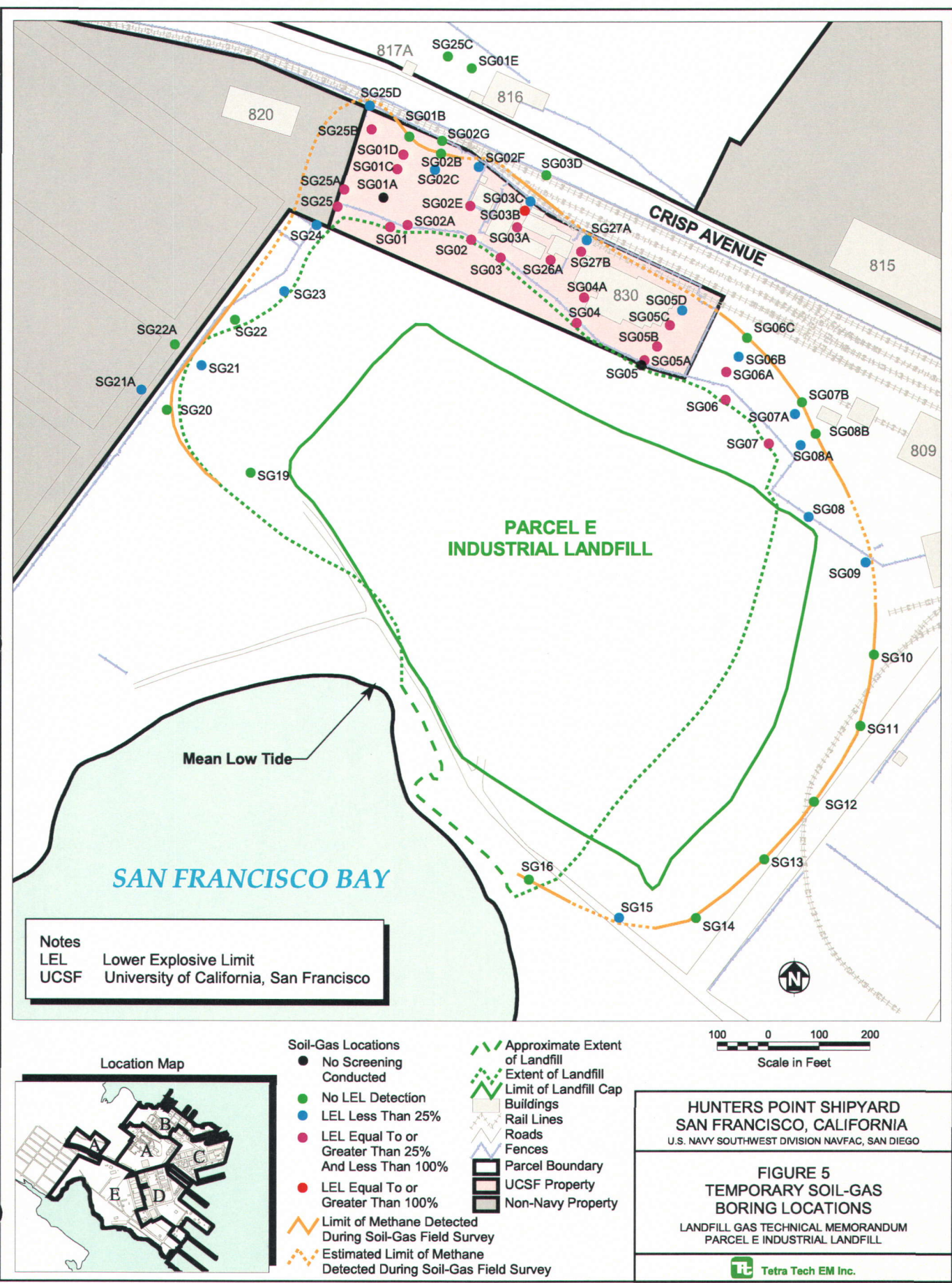


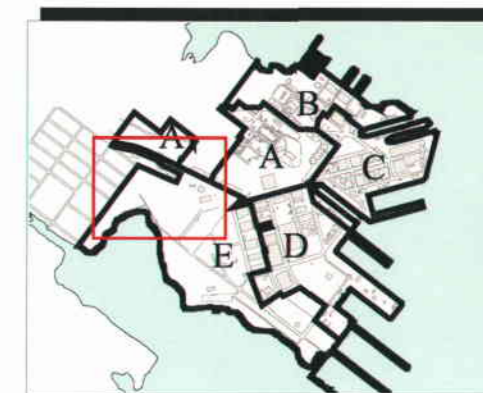
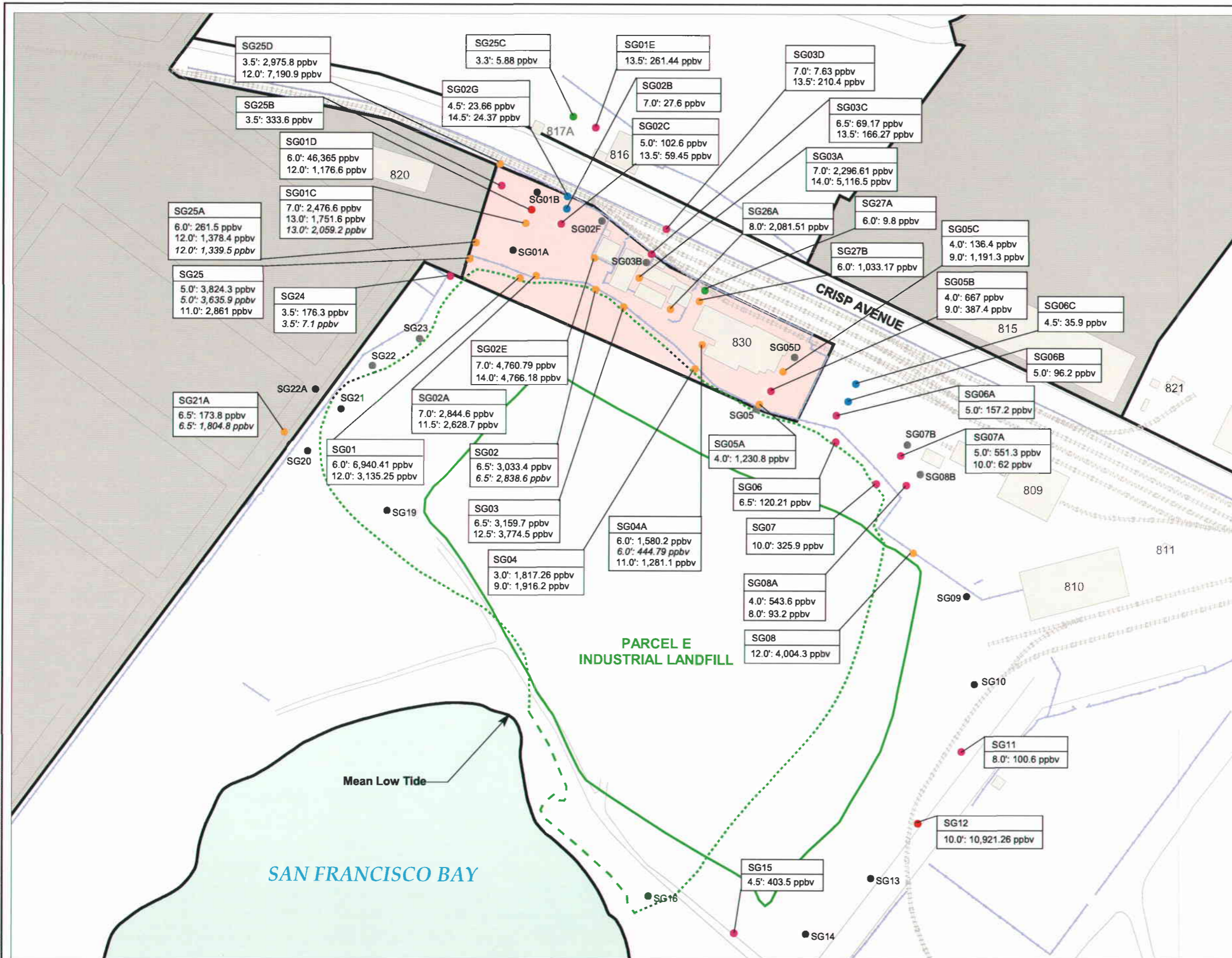
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
 U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

FIGURE 4
OFF-SITE AMBIENT AIR SURVEY
MARCH - APRIL 2002
 LANDFILL GAS TECHNICAL MEMORANDUM
 PARCEL E INDUSTRIAL LANDFILL

Tetra Tech EM Inc.

06-09-2002 a:\pointproject\parcel e non-standard data gas\fig tech memo.apr TDEM-SF kim huynh





Location Map

Soil-Gas with Summas Collected

- Total VOCs > 10,000 ppbv
- 1,000ppbv < Total VOCs < 10,000ppbv
- 100ppbv < Total VOCs < 1,000ppbv
- 10ppbv < Total VOCs < 100ppbv
- Total VOCs < 10ppbv

Soil-Gas Location With No Summas Collected

- Approximate Extent of Landfill
- Extent of Landfill
- Limit of Landfill Cap
- Buildings
- Rail Lines
- Roads
- Non-Navy Property
- Fences
- Parcel Boundary
- UCSF Property

Note
EPA Environmental Protection Agency
UCSF University of California, San Francisco
VOC Volatile organic compounds



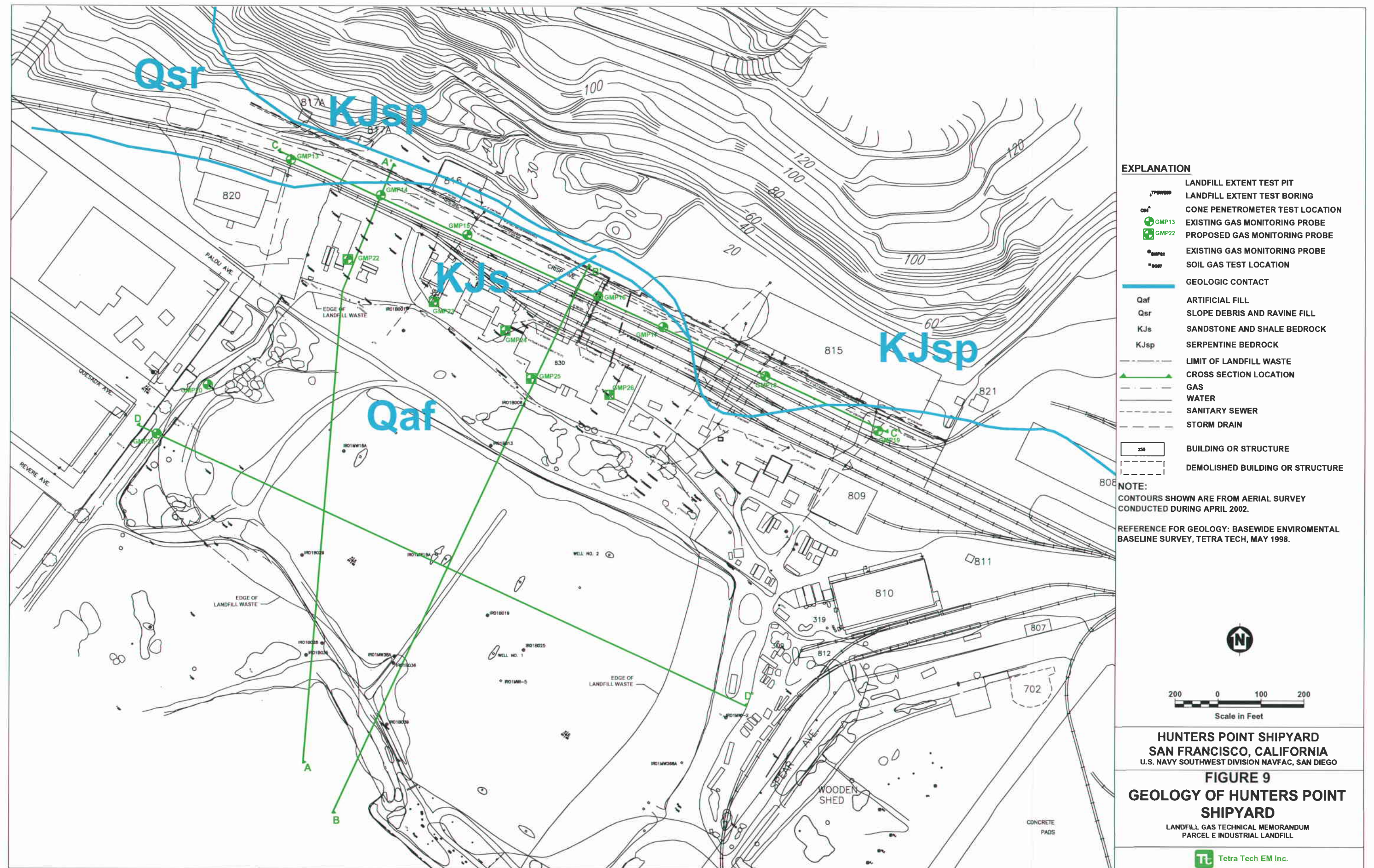
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Scale in Feet

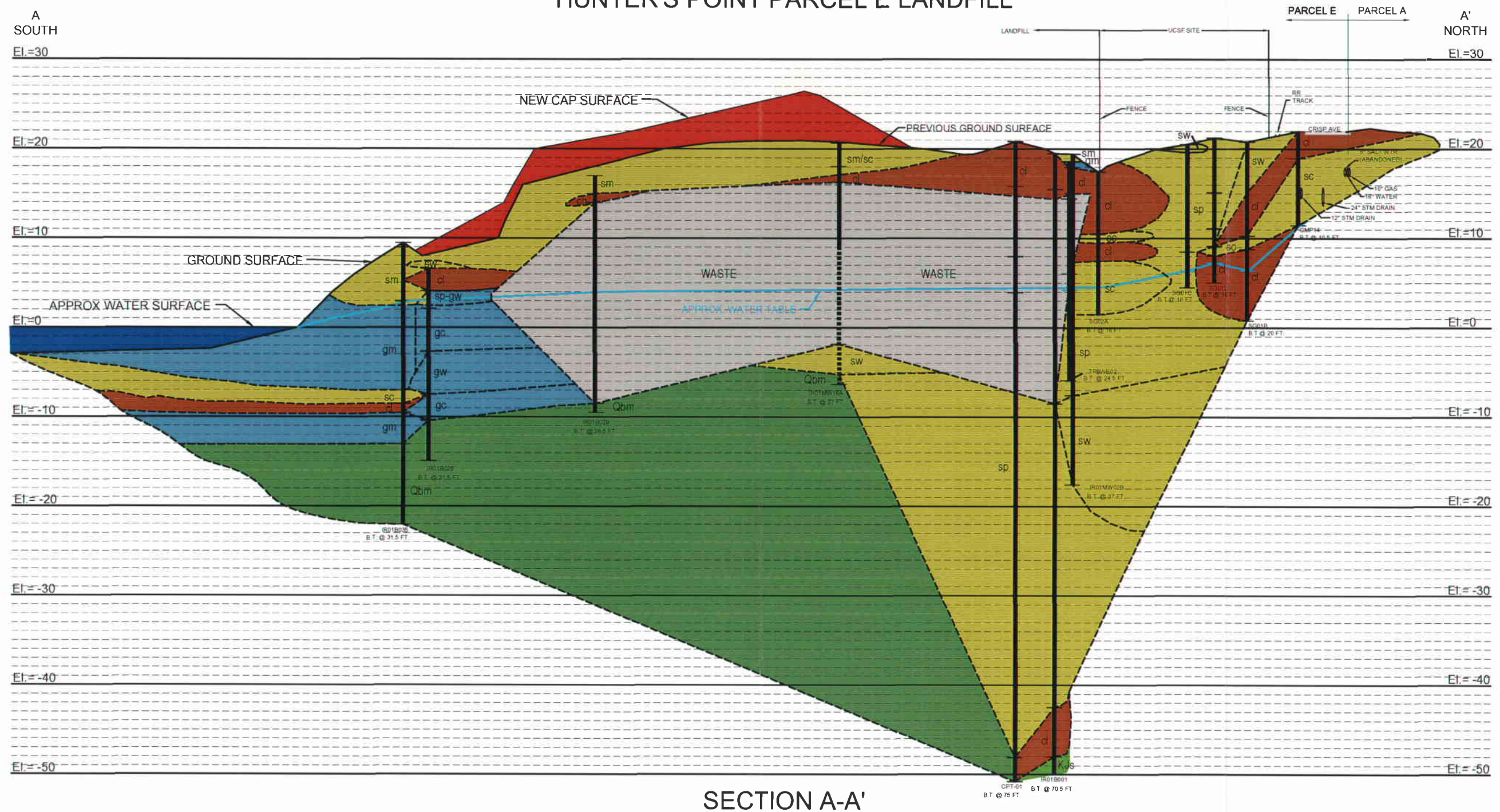
**HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO**

**FIGURE 7
SUMMARY OF TOTAL NONMETHANE
VOC LABORATORY DATA
(TEMPORARY SOIL-GAS SURVEY)
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL**





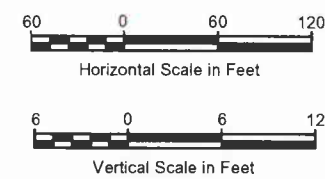
HUNTER'S POINT PARCEL E LANDFILL



NOTES:

- B.T. = Borehole termination
- Water table based on measurements at GMPs on June 5, 2002, and on observations during drilling April/May 2002.
- Geologic contact, dashed where inferred
- Stormwater sewer utility line
- Screened area

SECTION A-A'



GEOLOGIC DESCRIPTIONS

FILL SOILS:

- cl - Lean Clay
- ch - Fat Clay
- sp - Poorly Graded Sand
- sm - Silty Sand
- sc - Clayey Sand
- sw - Well Graded Sand
- gc - Clayey Gravel
- gw - Well Graded Gravel
- gm - Silty Gravel

NATIVE SOIL/ROCK:

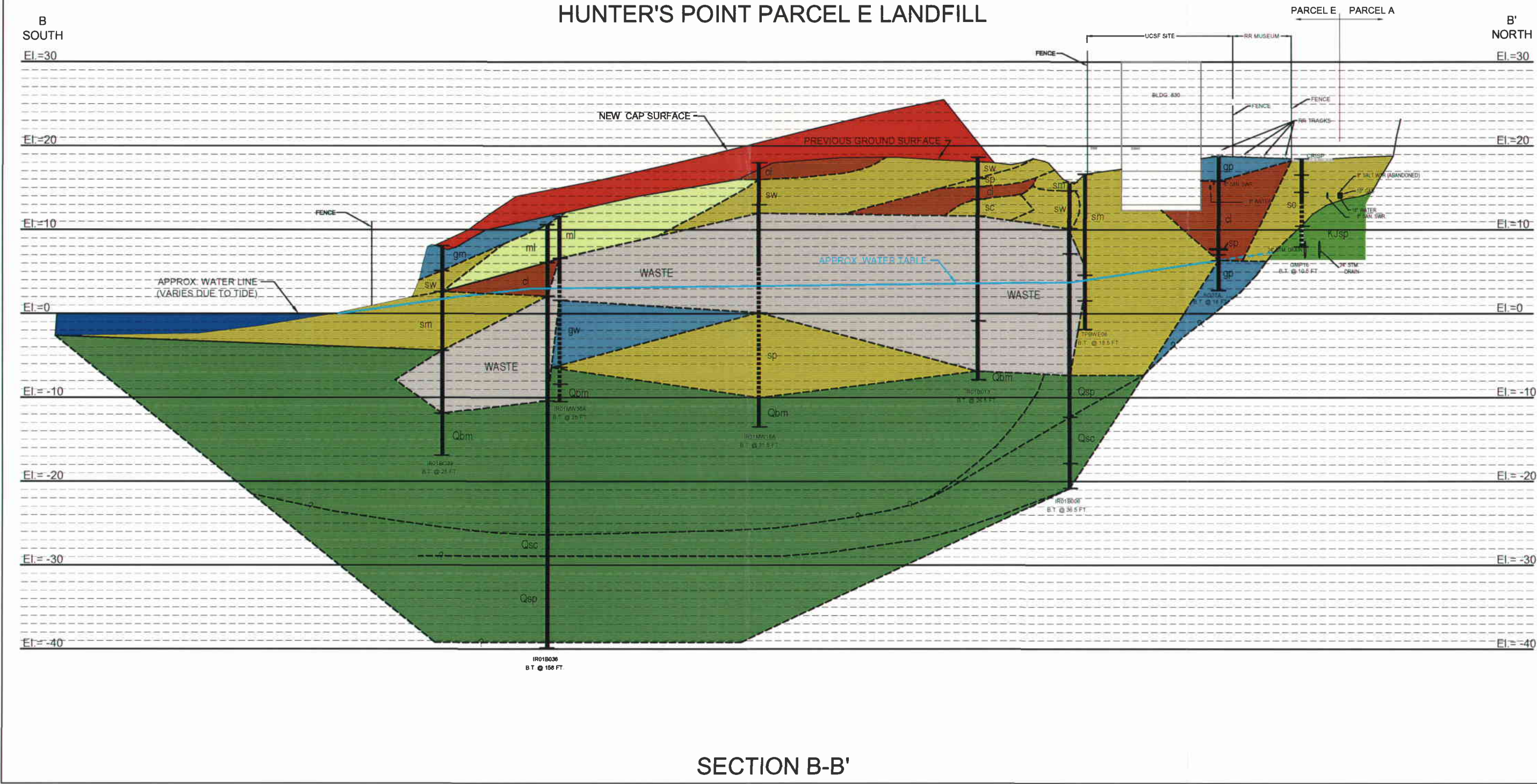
- Qbm - Bay Mud
- KJs - Shale Bedrock

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

FIGURE 10 CROSS SECTION A-A'

LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL

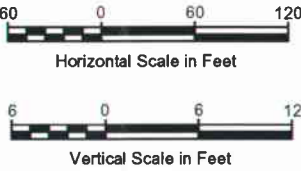
HUNTER'S POINT PARCEL E LANDFILL



SECTION B-B'

NOTES:

- B.T. = Borehole termination
- Water table based on measurements at GMPs on June 5, 2002, and on observations during drilling 5/31/02.
- Geologic contact, dashed where inferred
- Stormwater sewer utility line
- Screened area



GEOLOGIC DESCRIPTIONS

- FILL SOILS:
- cl - Lean Clay
 - sp - Poorly Graded Sand
 - sm - Silty Sand
 - sc - Clayey Sand
 - sw - Well Graded Sand
 - ml - Silt
 - gp - Poorly Graded Gravel
 - gw - Well Graded Gravel
 - gm - Silty Gravel
- NATIVE SOIL/ROCK:
- Qbm, Qsc, Qsp - Bay Mud
 - KJsp - Serpentine Bedrock

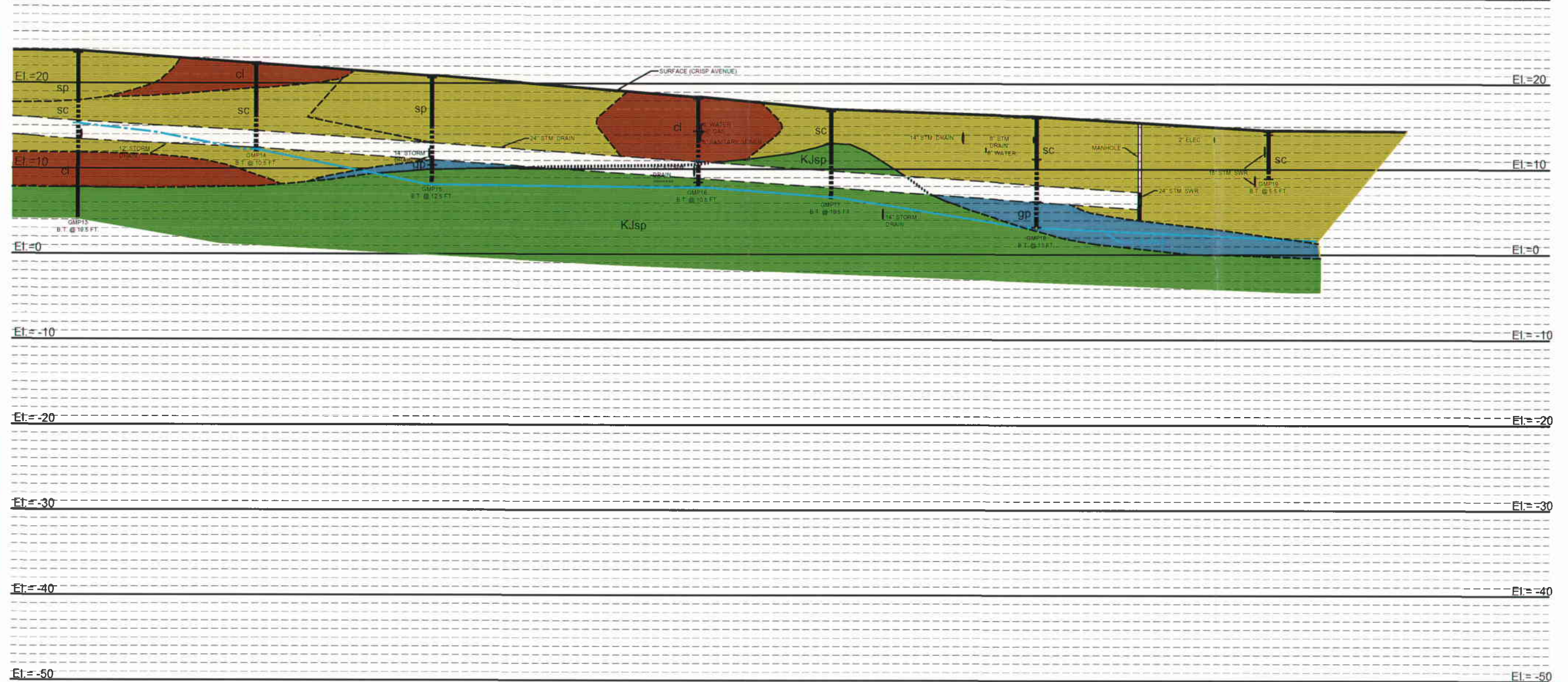
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

FIGURE 11
CROSS SECTION B-B'

LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL


C
WEST
EL.=30

C'
EAST
EI=30



NOTES:

B.T. = Borehole termination

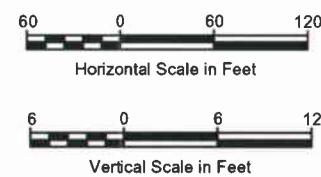
 Water table based on measurements at GMPs on June 5, 2002, on observations during drilling 5/31/02, and on monitoring well measurements in Feb. 2001.

----- Geologic contact, dashed where inferred

--- Stormwater sewer utility line



Screened area



FILL SOILS:

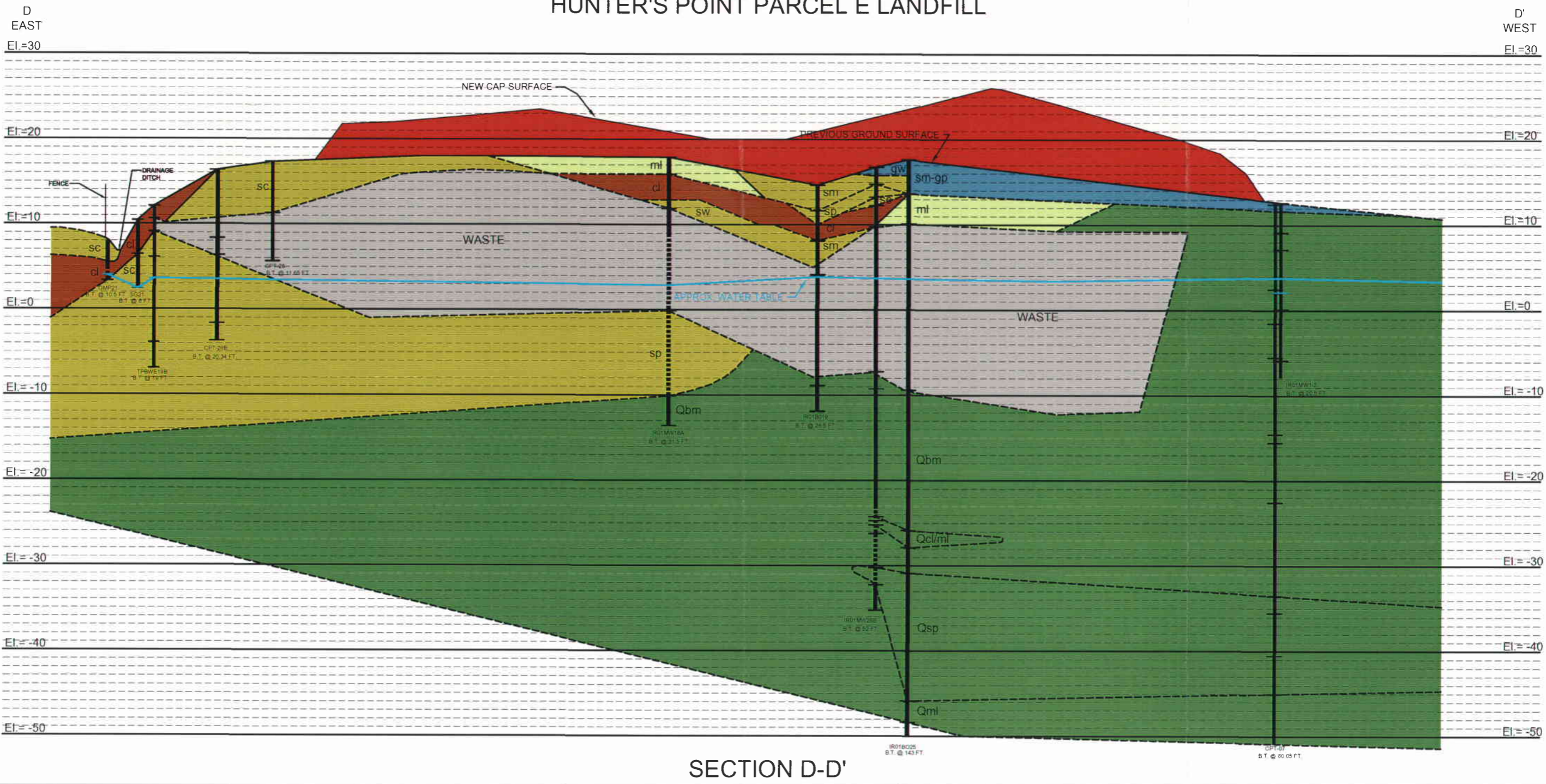
cl - Lean Clay
sp - Poorly Graded Sand
sc - Clayey Sand
gp - Poorly Graded Gravel

KJsp - Serpentine Bedrock

FIGURE 12
CROSS SECTION C-C'

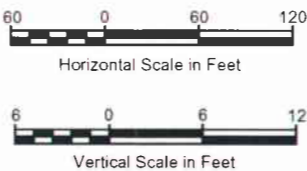
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL

HUNTER'S POINT PARCEL E LANDFILL



NOTES:

- B.T. = Borehole termination
- Water table based on measurements at GMPs on June 5, 2002, and on observations during drilling April/May 2002.
- Geologic contact, dashed where inferred
- Stormwater sewer utility line
- Screened area



GEOLOGIC DESCRIPTIONS

- FILL SOILS:
 - cl - Lean Clay
 - sp - Poorly Graded Sand
 - sm - Silty Sand
 - sc - Clayey Sand
 - sw - Well Graded Sand
 - ml - Silt
 - gp - Poorly Graded Gravel
 - gw - Well Graded Gravel
- NATIVE SOIL/ROCK:
 - Qbm/sc - Bay Mud
 - Qcl/ml - Clay/Silt

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

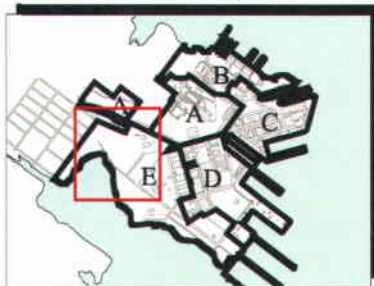
FIGURE 13
CROSS SECTION D-D'

LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL

Tetra Tech EM Inc.



Location Map



Historical Shoreline
 1935
 1946
 1969
 1985/1994

Approximate Extent of Landfill
 Parcel Boundary
 Buildings
 Rail Lines
 Roads

HUNTERS POINT SHIPYARD
 SAN FRANCISCO, CALIFORNIA
 U.S. NAVY SOUTHWEST DIVISION NAVFAC, SAN DIEGO

FIGURE 14

HISTORICAL SHORELINES
 LANDFILL GAS TECHNICAL MEMORANDUM
 PARCEL E INDUSTRIAL LANDFILL

Tetra Tech EM Inc.

TABLE 1

**ANALYTICAL AND FIELD EVALUATION METHODS
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Task	Location	Media	Analyte	Instrument/ Analytical Test	Method
On-Site Monitoring	Landfill cap, cap perimeter, wells, vents and vaults	Ambient air	Total nonmethane VOCs and LEL (methane)	Concentration: PID and CGI	Conducted in field in accordance with SOP No. 003 and GT Series Operator's Manual
On-Site Monitoring (for locations where methane was detected or were determined to be sensitive areas)	Light pole and Building 830 crawlspace	Ambient air	Specific VOCs; NMOC; and methane, oxygen, carbon dioxide, nitrogen, and carbon monoxide	Presence and concentration (collected in Summa® canister)	Analyses conducted at laboratory include EPA Methods TO-14a, 25C, and 3C
Off-Site Monitoring	Buildings, crawlspaces, and utility vaults	Soil-gas/ ambient air	Total nonmethane VOCs and LEL (methane)	Concentration: PID and CGI	Conducted in field in accordance with SOP No. 003 and GT Series Operator's Manual
Soil-Gas Survey	Landfill perimeter and stepped-out locations	Soil-gas	Methane and total nonmethane VOCs	Concentration: GEM 2000 and PID	Conducted in field in accordance with GEM 2000 Operation Manual and SOP No. 003
Soil-Gas Survey (for locations where PID readings exceed 5 ppm over background or methane exceeds 25 percent of the LEL)	Landfill perimeter and stepped-out locations	Soil-gas	Specific VOCs; NMOC; and methane, oxygen, carbon dioxide, nitrogen, and carbon monoxide	Presence and concentration (collected in Summa® canister)	Analyses conducted at laboratory include EPA Methods TO-14a, 25C, and 3C
Initial GMP Monitoring	GMPs and groundwater wells on the cap that have screened sections above the water table	Soil-gas	Methane, pressure, and temperature; total nonmethane VOCs; and water level	Concentration: GEM 2000, PID, and water level meter	Conducted in field in accordance with GEM 2000 Operation Manual, SOP No. 003, and SOP No. 014

TABLE 1 (Continued)

**ANALYTICAL AND FIELD EVALUATION METHODS
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Task	Location	Media	Analyte	Instrument/ Analytical Test	Method
Initial GMP Monitoring (for locations where PID readings exceed 5 ppm over background or methane exceeds 25 percent of the LEL)	GMPs and groundwater wells on the cap that have screened sections above the water table	Soil-gas	Specific VOCs; NMOC; and methane, oxygen, carbon dioxide, nitrogen, and carbon monoxide	Presence and concentration (collected in Summa® canister)	Analyses conducted at laboratory include EPA Methods TO-14a, 25C, and 3C
Long-Term Soil-Gas Monitoring	GMPs and IR01MW16A	Soil-gas	Methane, pressure, and temperature; total nonmethane VOCs; and water level	Concentration: GEM 2000, PID, and water level meter	Conducted in field in accordance with GEM 2000 Operation Manual, SOP No. 003, and SOP No. 014
Long-Term Soil-Gas Monitoring (for locations where PID readings exceed 5 ppm over background or methane exceeds 25 percent of the LEL)	GMPs and IR01MW16A	Soil-gas	Specific VOCs; NMOC; and methane, oxygen, carbon dioxide, nitrogen, and carbon monoxide	Presence and concentration (collected in Summa® canister)	Analyses conducted at laboratory include EPA Methods TO-14a, 25C, and 3C

Notes:

CGI Combustible gas indicator
EPA U.S. Environmental Protection Agency
GMP Gas monitoring probe
IR Installation Restoration
LEL Lower explosive limit
NMOC Non-methane organic carbon

PID Photoionization detector
ppm Parts per million
SOP Standard operating procedure
TO Toxic Organics
VOC Volatile organic compound

TABLE 2

**ON-SITE AMBIENT AIR SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID/Building Number	Location Description	Date	% LEL ^a
Perimeter of landfill cap	0 to 6 inches above ground surface	4/17/02	0
Transect 1 across landfill cap	0 to 6 inches above ground surface	4/17/02	0
Transect 2 across landfill cap	0 to 6 inches above ground surface	4/17/02	0
Transect 3 across landfill cap	0 to 6 inches above ground surface	4/17/02	0
Transect 4 across landfill cap	0 to 6 inches above ground surface	4/17/02	0
IR01MW42A	Outside of well	2/26/02	0
IR01MW42A	Inside of well	2/26/02	0
IR01MW366A	Outside of well	2/26/02	0
IR01MW366A	At lip of cap	2/26/02	2
IR01MW366A	Inside well; inner casing open	2/26/02	100
IR01MWI-2	Outside of well	2/26/02	0
IR01MWI-2	At lip of cap	2/26/02	1
IR01MWI-2	Inside well	2/26/02	70
Well A	Outside of well	2/26/02	0
Well A	At lip of cap	2/26/02	30
Well A	Inside well	2/26/02	100
Well B	Outside of well	2/26/02	0
Well B	At lip of cap	2/26/02	100
Well B	Inside well	2/26/02	2
IR01MW26B	Outside of well	2/26/02	0
IR01MW26B	At lip of cap	2/26/02	3
IR01MW26B	Inside well	2/26/02	26
IR01MWI-5	Outside of well	2/26/02	0
IR01MWI-5	At lip of cap	2/26/02	50
IR01MWI-5	Inside well	2/26/02	>100
IR01MW38A	Outside, within 1 foot of casing	2/26/02	1
IR01MW38A	At lip of cap	2/26/02	>100
IR01P18AB	Outside of well	2/26/02	0
IR01P18AB	At lip of cap	2/26/02	15
IR01P18AB	Inside well	2/26/02	100
IR01MW18A	Outside near well	2/26/02	100
IR01MW18A	At lip of cap	2/26/02	>100
IR01MW17B	Outside	2/26/02	0

TABLE 2 (Continued)

ON-SITE AMBIENT AIR SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

Location ID/Building Number	Location Description	Date	% LEL ^a
IR01MW17B	At lip of cap	2/26/02	50
IR01MW17B	Inside well	2/26/02	100
IR01MW16A	Outside of well	2/26/02	0
IR01MW16A	At lip of cap	2/26/02	>100
IR01MW16A	Inside well	2/26/02	>100
IR01MW31A	Outside of well	2/26/02	0
IR01MW31A	At lip of cap	2/26/02	0
IR01MW31A	Inside well (no casing lid)	2/26/02	0
IR01P03A	At lip of cap	2/26/02	0
IR01P03AA	At lip of cap	2/26/02	0
IR01MW03A	Inside well	2/26/02	0
IR01P03AB	At lip of cap	2/26/02	0
IR01MW02B	At lip of cap	2/26/02	0
IR01MWI-3	At lip of inner casing	2/26/02	0
IR01MWI-3	Inside well	2/26/02	>20 ^b
Landfill Cap Perimeter	0 to 3 inches above ground surface	2/26/02	0
Landfill Cap	Southwestern corner of cap, within 20-foot radius	2/26/02	0
Vicinity of IR01MWI-3	10 feet southwest of IR01MWI-3	2/26/02	0
Vault A	At hole on vault lid	2/26/02	>20 ^b
Electrical Substation	Ambient and ground surface	2/26/02	0

Notes:

a As read on a CGI or converted from an FID.

b Measured concentration was above the maximum detection limit of 10,000 parts per million on the FID. CGI was malfunctioning.

%LEL Percent of lower explosive limit

CGI Combustible gas indicator

FID Flame ionization detector

ID Identification

IR Installation Restoration

TABLE 3

**OFF-SITE AMBIENT AIR SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID/Building Number	Date	% LEL ^a	Location Description/Comments
Building 809	3/4/02	0	Flat slab-on-grade, one door open, no wind inside, no subsurface features, rail line runs through building in east-west direction; surveyed on transects of 20-foot grids
Building 809	3/4/02	0	Rail line in Building 809
Utility Trailer	3/4/02	0	In front of Building 809, sits 2 feet above ground; surveyed perimeter and crawl space
Sandblast Towers	3/4/02	0	Two sandblast towers next to utility trailer; sandblast waste observed inside is brown
Warehouse 1	3/4/02	0	Shed south of Building 809; surveyed ambient air and floor
Storage Shed 1	3/4/02	0	Steel unit 30 feet north of cap, contains empty oil drums; surveyed crawl space
Storage Shed 2	3/4/02	0	No subsurface features; surveyed inside
Storage Shed 3	3/4/02	0	Quonset hut; surveyed ambient air and floor
Building 808	3/4/02	0	Large open-space building; one subgrade feature (rail line) 4 feet deep; surveyed floor
Building 815	3/4/02	0	Large building; surveyed basement and ground floor
Building 830	3/4/02	0	UCSF hallway and back room
Building 830	3/4/02	0	Parking lot, southwestern end
Building 830	3/4/02	0	Parking lot, northwestern end; including underground sump (possibly sewer discharge) and subgrade utility lines
UCSF South Fenceline	3/4/02	0	South of Building 830
UCSF South Fenceline	3/4/02	18	Location A
UCSF South Fenceline	3/4/02	0	Fire hydrant 2
Near Shed	3/4/02	37	Location B
UCSF South Fenceline	3/4/02	5	Location C
UCSF South Fenceline	3/4/02	0	Location D and westward to location E
UCSF South Fenceline	3/4/02	0	Location E
UCSF South Fenceline	3/4/02	>100	Location F (by telephone pole)
UCSF South Fenceline	3/4/02	0	Location G (by northwest telephone pole)
UCSF South Fenceline	3/4/02	0	Location H (telephone pole by kennel)
Building 817A Vault	3/5/02	0	Deep, possibly underground pipe
Building 817A	3/5/02	0	Building did not have number; "816" spray-painted on front; surveyed perimeter at ground-to-building interface, and at small 1-inch-diameter hole in back wall

TABLE 3 (Continued)

**OFF-SITE AMBIENT AIR SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID/Building Number	Date	% LEL ^a	Location Description/Comments
Building 817A Lot	3/5/02	0	Located east of Building 817A; surveyed ambient air and floor
N1	3/5/02	0	Possibly Building 816 (footprint is not found), welded shut; surveyed ambient air, perimeter, ground-to-building interface
Storm Drain 1	3/5/02	0	Storm drain just south of N1
N1 Hillside	3/5/02	0	Surveyed hillside and two ponds; ambient air and at floor
Storm Drain 2	3/5/02	0	Storm drain just south of N1
Storm Drain 3	3/5/02	0	Storm drain just south of N1
Crisp Ave	3/5/02	0	South side along fence, from north end to south end of fence (Spear Street); surveyed 2 inches above ground
PG&E Vault 1	3/5/02	0	
PG&E Vault 2	3/5/02	0	
Storm Drain 4	3/5/02	0	
PG&E Vault 3	3/5/02	0	
Vault 1	3/5/02	0	
Storm Drain 5	3/5/02	0	
Manhole 1	3/5/02	0	
Manhole 2	3/5/02	0	VOCs measured at 4 ppm ^b
Manhole 3	3/5/02	0	
Storm Drain 6	3/5/02	0	
Trenchbox	3/5/02	0	
Manhole 4	3/5/02	0	
Building 810	3/6/02	0	Flat slab-on-grade, usually locked, stores miscellaneous office and furniture supplies
IR72B005	3/6/02	0	Inside Building 810, old boring filled with concrete
Storm Drain 1	3/6/02	0	Located east of Building 817A; surveyed ambient air and floor
Manhole 1	3/6/02	0	Possibly Building 816 (footprint is not found), welded shut; surveyed ambient air, perimeter, ground-to-building interface
UCSF South Fenceline	3/29/02	0	South of Building 830
UCSF South Fenceline	3/29/02	0	Location A
UCSF South Fenceline	3/29/02	0	Location C

TABLE 3 (Continued)

**OFF-SITE AMBIENT AIR SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID/Building Number	Date	% LEL^a	Location Description/Comments
UCSF South Fenceline	3/29/02	0	Location D and westward to location E
UCSF South Fenceline	3/29/02	0	Location E
UCSF South Fenceline	3/29/02	0	Location F (by telephone pole)
Light pole at UCSF	3/29/02	0	Ground surface
Building 830	4/3/02	0	Crawlspace
Light Pole at UCSF	4/5/02	0	Ground surface
Light Pole at UCSF	4/25/02	20	Ground surface
Building 830	4/25/02	0	Crawlspace

Notes:

- a As read on a CGI or converted from an FID
- b Nonmethane VOCs as read on a PID

% LEL Percent of lower explosive level
 CGI Combustible gas indicator
 FID Flame ionization detector
 ID Identification
 IR Installation restoration
 PG&E Pacific Gas and Electric Co.
 PID Photoionization detector
 ppm Parts per million
 UCSF University of California, San Francisco
 VOC Volatile organic compound

TABLE 4

**SUMMARY OF LABORATORY ANALYTICAL DATA (AMBIENT AIR SAMPLES)
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Sample ID:	SCGSSG001		SGLPSG001		Preliminary Remediation Goal (ppbv)
Sample Location:	Crawl Space of Bldg. 830		UCSF Light Pole (Location F)		
Point Name:	SGCS		SGLP		
Sample Type:	Ambient Air		Ambient Air		
EPA Method 25C (ppmv)					
Methane	580		0.14	U	NA
NMOC	13.7	U	0.14	U	NA
EPA Method 3C (%)					
Carbon Dioxide	0.1	J	0.14	U2	NA
Carbon Monoxide	0.14	U	0.14	U	NA
Methane	0.1	J	0.14	U	NA
Nitrogen	81.48		81.03		NA
Oxygen	19.5	J8	18.95	J8	NA
TO-14 (ppbv)					
1,1,1-Trichloroethane	3.44	U	1.35	U	180.21
1,1,2,2-Tetrachloroethane	3.44	U	1.18	J	0.0047
1,1,2-Trichloro-1,2,2-trifluoro	3.44	U	2.41		3976.73
1,1,2-Trichloroethane	3.44	U	1.35	U	0.02
1,1-Dichloroethane	3.44	U	1.35	U	0.29
1,1-Dichloroethylene	3.44	U	1.35	U	0.01
1,2,4-Trichlorobenzene	3.44	U	1.35	U	27.83
1,2,4-Trimethylbenzene	3.44	U	2.31	U2	1.24
1,2-Dibromoethane	3.44	U	1.35	U	0.0011
1,2-Dichloro-1,1,2,2-tetrafluoroethane	3.44	U	0.81	J	NA
1,2-Dichlorobenzene	3.44	U	2.22	U2	34.34
1,2-Dichloroethane	3.44	U	1.35	U	0.02
1,2-Dichloropropane	3.44	U	1.35	U	0.02
1,3,5-Trimethylbenzene	3.44	U	1.31	J	1.24
1,3-Butadiene	3.44	U	1.35	U	0.0016
1,3-Dichlorobenzene	3.44	U	1.76	U2	0.54
1,4-Dichlorobenzene	3.44	U	2.23	U2	0.05
1,4-Dioxane	3.44	U	1.35	U	0.17
2-Butanone (MEK)	3.4	U4	1.35	U	333.43
2-Hexanone	3.44	U	1.35	UJ7	NA
4-Ethyltoluene	3.44	U	1.46		NA
4-Methyl-2-pentanone (MiBK)	3.44	U	1.35	U	19.91
Acetone	12.08	U4	9.81	U2	153.09

TABLE 4 (Continued)

SUMMARY OF LABORATORY ANALYTICAL DATA (AMBIENT AIR SAMPLES)
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

Sample ID:	SCGSSG001		SGLPSG001		Preliminary Remediation Goal (ppbv)
Sample Location:	Crawl Space of Bldg. 830		UCSF Light Pole (Location F)		
Point Name:	SGCS		SGLP		
Sample Type:	Ambient Air		Ambient Air		
TO-14 (ppbv) (Continued)					
Benzene	3.44	U	1.01	J	0.08
Benzyl Chloride	3.44	U	1.35	U	0.01
Bromodichloromethane	3.44	U	1.35	U	0.02
Bromoform	3.44	U	1.35	U	0.16
Bromomethane	3.44	U	1.35	U	1.32
Carbon Disulfide	3.44	U	2.05	U2	230.61
Carbon Tetrachloride	3.44	U	1.35	U	0.02
Chlorobenzene	3.44	U	1.35	U	13.24
Chloroethane	3.44	U	1.35	U	0.86
Chloroform	3.44	U	1.35	U	0.02
Chloromethane	1.43	J	1.93	U2	0.52
cis-1,2-Dichloroethene	3.44	U	1.35	U	9.18
cis-1,3-Dichloropropene	3.44	U	1.35	U	0.10
Cyclohexane	3.44	U	1.35	U	5995.72
Dibromochloromethane	3.44	U	1.35	U	0.01
Dichlorodifluoromethane	1.79	J	1.4	U2	41.76
Ethanol	3.4	J	235.88	U2	NA
Ethylbenzene	3.44	U	0.84	J	249.00
Heptane	3.44	U	1.4	U2	NA
Hexachlorobutadiene	3.44	U	1.35	U	0.008
Hexane	2.39	J	1.35	U	58.57
Isopropyl Alcohol	3.44	U	17.09	U2	NA
M,P-Xylenes	4.22		1.78	U2	165.25
Methylene Chloride	7.85	U4	4.09	U4	1.16
MTBE	3.44	U	1.35	U	1.01
O-Xylene	1.61	J	0.86	J	165.25
Propylene	5.42		1.41	U2	NA
Styrene	3.44	U	1.35	U	253.78
t-1,2-Dichloroethylene	3.44	U	1.35	U	18.11
t-1,3-Dichloropropene	3.44	U	1.35	U	0.10
Tetrachloroethylene	1.73	J	1.35	U	0.05
Tetrahydrofuran	3.44	U	1.35	U	0.33
Toluene	2.53	J	1.54	U2	104.41

TABLE 4 (Continued)

**SUMMARY OF LABORATORY ANALYTICAL DATA (AMBIENT AIR SAMPLES)
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Sample ID:	SCGSSG001	SGLPSG001	Preliminary Remediation Goal (ppbv)		
Sample Location:	Crawl Space of Bldg. 830	UCSF Light Pole (Location F)			
Point Name:	SGCS	SGLP			
Sample Type:	Ambient Air	Ambient Air			
TO-14 (ppbv) (Continued)					
Trichloroethene	3.44	U	1.35	U	0.20
Trichlorofluoromethane	3.44	U	1.4	U2	127.72
Vinyl Acetate	3.44	U	1.35	U	58.63
Vinyl Chloride	3.44	U	1.35	U	0.08

Notes:

Bldg. Building
 EPA U.S. Environmental Protection Agency
 ID Identification
 J Estimated
 J8 Calibration range problems
 MTBE Methyl-tertiary-butyl-ether
 NA Not applicable
 NMOC Nonmethane organic hydrocarbons
 ppbv Parts per billion by volume
 ppmv Parts per million per volume
 TO Toxic Organics
 U Nondetected
 U2 Field blank problems
 U4 Lab contaminant
 UCSF University of California, San Francisco
 UJ7 Calibration problems

TABLE 5

**TEMPORARY SOIL-GAS SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID	Sample Depth (feet bgs) ^a	Methane (% vol. in air)	% LEL	VOCs ^b (ppm)	Trigger for Sample Collection	Sample ID	Step-Out (Y/N)	Step-Out Location
SG01	6.0	66.9	1338	0.0	Methane	SG01SG001	Y	SG01A
SG01	12.0	56.6	1132	0.5	Methane	SG01SG002	Y	SG01A
SG01A	NA	NA	NA	NA	NA	NA	Y	SG01C
SG01B	4.0	0.0	0	4.3	NA	NA	Y	SG01E
SG01B	10.0	0.0	0	0.0	NA	NA	Y	SG01E
SG01C	7.0	50.3	1006	1.1	Methane	SG01SG003	Y	SG01D
SG01C	13.0	15.1	302	7.6	Methane and VOCs	SG01SG004	Y	SG01D
SG01D	6.0	43.3	866	15.7	Methane and VOCs	SG01SG006	Y	SG01B
SG01D	12.0	32.6	652	0.0	Methane	SG01SG007	Y	SG01B
SG01E	7.5	0.0	0	3.8	NA	NA	N	NA
SG01E	13.5	0.0	0	5.5	VOCs	SG01SG008	N	NA
SG02	6.5	67.4	1348	0.0	Methane	SG02SG009	Y	SG02E
SG02	12.5	65.3	1306	1.1	Methane	SG02SG010	Y	SG02E
SG02A	7.0	54.0	1080	0.4	Methane	SG02SG001	Y	SG02C
SG02A	11.5	60.1	1202	0.7	Methane	SG02SG002	Y	SG02C
SG02B	7.0	0.0	0	5.1	VOCs	SG02SG003	Y	SG02G
SG02B	13.5	0.0	0	3.9	NA	NA	Y	SG02G
SG02C	5.0	0.5	10	5.0	VOCs	SG02SG004	Y	SG02B
SG02C	13.5	2.4	48	0.7	Methane	SG02SG005	Y	SG02B
SG02E	7.0	66.6	1332	1.2	Methane	SG02SG006	Y	SG02F
SG02E	14.0	57.0	1140	2.3	Methane	SG02SG007	Y	SG02F
SG02F	7.0	0.2	4	0.7	NA	NA	N	NA
SG02F	14.0	1.1	22	2.4	NA	NA	N	NA
SG02G	4.5	0.0	0	0.0	Field Confirmation	SG02SG011	N	NA

TABLE 5 (Continued)

**SOIL-GAS SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID	Sample Depth (feet bgs) ^a	Methane (% vol. in air)	% LEL	VOCs ^b (ppm)	Trigger for Sample Collection	Sample ID	Step-Out (Y/N)	Step-Out Location
SG02G	14.5	0.0	0	0.5	Field Confirmation	SG02SG012	N	NA
SG03	6.5	69.7	1394	0.3	Methane	SG03SG005	Y	SG03A
SG03	12.5	60.0	1200	0.0	Methane	SG03SG006	Y	SG03A
SG03A	7.0	78.6	1572	1.4	Methane	SG03SG001	Y	SG03B
SG03A	14.0	83.9	1678	1.5	Methane	SG03SG002	Y	SG03B
SG03B	NA	NA	NA	NA	NA	NA	Y	SG03C
SG03C	6.5	19.7	394	0.0	Methane	SG03SG003	Y	SG03D
SG03C	13.5	3.2	64	0.0	Methane	SG03SG004	Y	SG03D
SG03D	7.0	0.0	0	0.0	Field Confirmation	SG03SG007	N	NA
SG03D	13.5	0.0	0	0.7	Field Confirmation	SG03SG008	N	NA
SG04	3.0	68.4	1368	0.0	Methane	SG04SG001	Y	SG04A
SG04	9.0	16.4	328	1.2	Methane	SG04SG002	Y	SG04A
SG04A	6.0	63.0	1260	0.6	Methane	SG04SG003	Y	SG27B
SG04A	11.0	32.8	656	1.0	Methane	SG04SG005	Y	SG27B
SG05	NA	NA	NA	NA	NA	NA	NA	NA
SG05A	4.0	74.7	1494	0.0	Methane	SG05SG001	Y	SG05B
SG05B	4.0	59.8	1196	0.0	Methane	SG05SG002	Y	SG05C
SG05B	9.0	51.1	1022	0.0	Methane	SG05SG003	Y	SG05C
SG05C	4.0	43.8	876	0.0	Methane	SG05SG004	Y	SG05D
SG05C	9.0	39.4	788	0.0	Methane	SG05SG005	Y	SG05D
SG05D	5.0	0.0	0	2.6	NA	NA	N	NA
SG05D	10.0	0.3	6	2.9	NA	NA	N	NA
SG06	6.5	45.9	918	0.1	Methane	SG06SG001	Y	SG06A
SG06A	5.0	50.0	1000	0.0	Methane	SG06SG002	Y	SG06B

TABLE 5 (Continued)

**SOIL-GAS SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID	Sample Depth (feet bgs) ^a	Methane (% vol. in air)	% LEL	VOCs ^b (ppm)	Trigger for Sample Collection	Sample ID	Step-Out (Y/N)	Step-Out Location
SG06B	5.0	5.0	100	0.0	Methane	SG06SG003	Y	SG06C
SG06C	4.5	NA	0	1.6	Field Confirmation	SG06SG004	N	NA
SG06C	9.0	0.0	0	1.3	NA	NA	N	NA
SG07	5.5	0.0	0	1.3	NA	NA	Y	SG07A
SG07	10.0	75.2	1504	0.0	Methane	SG07SG001	Y	SG07A
SG07A	5.0	3.9	78	0.2	Methane	SG07SG002	Y	SG07B
SG07A	10.0	0.9	18	0.6	Methane	SG07SG003	Y	SG07B
SG07B	3.0	0.0	0	0.9	NA	NA	N	NA
SG08	8.0	0.1	2	2.2	NA	NA	Y	SG08A
SG08	12.0	10.4	208	0.0	Methane	SG08SG001	Y	SG08A
SG08A	4.0	17.0	340	0.0	Methane	SG08SG002	Y	SG08B
SG08A	8.0	9.4	188	0.0	Methane	SG08SG003	Y	SG08B
SG08B	5.0	0.0	0	1.8	NA	NA	N	NA
SG09	6.5	0.2	4	0.0	NA	NA	N	NA
SG09	10.0	0.0	0	0.1	NA	NA	N	NA
SG10	3.0	0.0	0	2.9	NA	NA	N	NA
SG10	7.0	0.0	0	3.2	NA	NA	N	NA
SG11	5.0	0.0	0	3.9	NA	NA	N	NA
SG11	8.0	0.0	0	229.8	VOCs	SG11SG001	N	NA
SG12	5.0	0.0	0	0.1	NA	NA	N	NA
SG12	10.0	0.0	0	21.1	VOCs	SG12SG001	N	NA
SG13	4.0	0.0	0	0.0	NA	NA	N	NA
SG14	5.0	0.0	0	0.0	NA	NA	N	NA
SG15	4.5	0.4	8	85.5	VOCs	SG15SG001	N	NA

TABLE 5 (Continued)

**SOIL-GAS SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID	Sample Depth (feet bgs) ^a	Methane (% vol. in air)	% LEL	VOCs ^b (ppm)	Trigger for Sample Collection	Sample ID	Step-Out (Y/N)	Step-Out Location
SG16	4.0	0.0	0	2.4	NA	NA	N	NA
SG17	NA	NA	NA	NA	NA	NA	N	NA
SG18	NA	NA	NA	NA	NA	NA	N	NA
SG19	5.0	0.0	0	3.2	NA	NA	N	NA
SG19	10.0	0.0	0	0.1	NA	NA	N	NA
SG20	3.0	0.0	0	0.0	NA	NA	N	NA
SG21	7.0	0.5	10	0.6	NA	NA	Y	SG21A
SG21A	6.5	0.2	4	8.1	VOCs	SG21SG001	N	NA
SG22	4.0	0.0	0	0.0	NA	NA	Y	SG22A
SG22A	7.5	0.0	0	3.1	NA	NA	N	NA
SG23	4.0	0.1	2	4.4	NA	NA	N	NA
SG24	3.5	0.2	4	2.3	Field Confirmation	SG24SG001	N	Access denied for step-out
SG25	5.0	71.6	1432	2.6	Methane	SG25SG001	Y	SG25A
SG25	11.0	72.5	1450	0.1	Methane	SG25SG003	Y	SG25A
SG25A	6.0	73.3	1466	0.2	Methane	SG25SG004	Y	SG25B
SG25A	12.0	71.3	1426	0.0	Methane	SG25SG005	Y	SG25B
SG25B	3.5	54.8	1096	0.0	Methane	SG25SG007	Y	SG25D
SG25B	11.5	0.2	4	0.0	NA	NA	Y	SG25D
SG25C	3.3	0.0	0	6.5	VOCs	SG25SG008	N	NA
SG25D	3.5	0.1	2	0.4	Field Confirmation	SG25SG009	Y	SG25C
SG25D	12.0	0.2	4	1.5	Field Confirmation	SG25SG010	Y	SG25C
SG26	NA	NA	NA	NA	NA	NA	NA	NA
SG26A	8.0	32.9	658	1.9	Methane	SG26SG001	Y	SG27A

TABLE 5 (Continued)

**SOIL-GAS SURVEY FIELD DATA
LANDFILL GAS TECHNICAL MEMORANDUM
PARCEL E INDUSTRIAL LANDFILL
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Location ID	Sample Depth (feet bgs) ^a	Methane (% vol. in air)	% LEL	VOCs ^b (ppm)	Trigger for Sample Collection	Sample ID	Step-Out (Y/N)	Step-Out Location
SG27	NA	NA	NA	NA	NA	NA	NA	NA
SG27A	6.0	0.1	2	6.5	VOCs	SG27SG001	N	NA
SG27A	12.0	0.2	4	4.6	NA	NA	N	NA
SG27B	6.0	46.6	932	0.0	Methane	SG27SG002	Y	SG27A

Notes:

a Sample depth represents the location of the bottom of 3-inch-long sample screen.

b VOCs minus background readings

%LEL Percent of lower explosive limit calculated from the methane field measurements in percent volume in air

bgs Below ground surface

ID Identification

NA Not available

ppm Parts per million

VOC Volatile organic compound

vol. Volume